



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**CHEMISTRY**

**0620/41**

Paper 4 Extended Theory

**October/November 2016**

MARK SCHEME

Maximum Mark: 80

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**Published**

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)	<b>H</b>	<b>1</b>
1(b)	<b>G</b>	<b>1</b>
1(c)	filtration	<b>1</b>
1(d)	fractional distillation	<b>1</b> <b>1</b>
1(e)	add/mix/stir/dissolve/shake/heat with water filter/decant heat (filtrate) or (leave filtrate to) evaporate	<b>1</b> <b>1</b> <b>1</b>
1(f)	electrons (electrons) move/flow (throughout structure)	<b>1</b> <b>1</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)(i)	melt(ing)	<b>1</b>
2(a)(ii)	sublimation/sublime	<b>1</b>
2(a)(iii)	condensing/condensation	<b>1</b>
2(b)	overcome/break the attractive forces	<b>1</b>
2(c)	<b>E AND</b> particles hit the walls (of the container) more often	<b>1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(a)(i)	heated / evaporated / boiled	<b>1</b>
3(a)(ii)	any 2 from: ( <input type="radio"/> ) is) more viscous / thicker ( <input type="radio"/> ) is) darker ( <input type="radio"/> ) has) longer / bigger molecules / more carbon atoms ( <input type="radio"/> ) has a) higher boiling point <b>OR</b> melting point ( <input type="radio"/> ) is) less flammable	<b>2</b>
3(b)	any 2 from: similar / same chemical properties same functional group trend / pattern in physical properties (neighbouring members) differ by CH <sub>2</sub> common methods of preparation	<b>2</b>
3(c)	any 2 structures from: pentane methylbutane dimethylpropane	<b>2</b>
3(d)	correct structure with any number from 1 to 6 of the hydrogen atoms replaced by chlorine atoms	<b>1</b>
3(e)(i)	(ends in) ene	<b>1</b>
3(e)(ii)	<b>M1</b> 88.24 / 12 <b>AND</b> 11.76 / 1 <b>M2</b> 7.353 / 7.353 (= 1) <b>AND</b> 11.76 / 7.353 = (1.6) <b>M3</b> C <sub>5</sub> H <sub>8</sub>	<b>1</b> <b>1</b> <b>1</b>
3(e)(iii)	relative molecular mass	<b>1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)(i)	$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ <b>M1</b> formulae <b>M2</b> balancing	<b>2</b>
4(a)(ii)	(nitrogen) air / atmosphere (hydrogen) steam / water / hydrocarbons / natural gas	<b>1</b> <b>1</b>
4(a)(iii)	(temperature) answer in range 370–470 °C (pressure) answer in range 150–300 atm	<b>1</b> <b>1</b>
4(b)(i)	<b>M1</b> forward and reverse reactions (occur) <b>M2</b> amounts / moles / concentrations (of reagents and products) constant <b>OR</b> <b>M2</b> rate of forward and reverse reactions equal	<b>1</b> <b>1</b>
4(b)(ii)	<u>endothermic</u> <b>AND</b> yield increases as temperature increases	<b>1</b>
4(b)(iii)	<b>M1</b> yield decreases (as pressure increases) <b>M2</b> because more moles / molecules (of gas) on the right <b>M3</b> so position of equilibrium moves left	<b>1</b> <b>1</b> <b>1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)	(gas) oxygen (test) glowing splint (result of test) relights	1 1 1
5(b)	reference to ions/ionic ions cannot move in solid <b>OR</b> are in fixed positions in solid ions can move when in solution	1 1 1
5(c)(i)	copper ions / $\text{Cu}^{2+}$ gain of electrons / oxidation number decreases	1 1
5(c)(ii)	any 3 from: anode decreases (in mass) copper removed (from anode) / solid (copper from anode) becomes aqueous cathode increases (in mass) copper deposited / added / $\text{Cu}^{2+}$ deposited as Cu (on cathode)	3
5(c)(iii)	copper is both added and removed (at same rate) <b>OR</b> the concentration (of copper ions) does not change	1

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(a)	large / big molecule made from (many) monomers (joined together)	1 1
6(b)(i)	amide / peptide	1
6(b)(ii)	(can be) broken down by microbes / bacteria	1 1
6(b)(iii)	starch / cellulose / DNA / RNA / polysaccharides /	1

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Question	Answer	Marks
6(c)(i)	<b>M1</b> at least one correct ester linkage between boxes	1
	<b>M2</b> at least two boxes shown and sufficient correct C and O atoms to make <b>two correct</b> ester linkages	1
	<b>M3</b> continuation bond(s) <b>AND</b> if more than one repeat unit is shown, the repeat unit must be correctly identified	1

Question	Answer	Marks
7(a)	0.025	
	<b>M1</b> 50 / 1000 (=0.05)	1
	<b>M2</b> (0.05 × 0.5) = 0.025	1
7(b)	0.0125	1
7(c)	0.55	
	<b>M1</b> 44	1
	<b>M2</b> 0.55	1
7(d)	0.3	1

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
8(a)(i)	any 4 from: slowed down acid became less concentrated <b>OR</b> fewer particles per unit volume fewer collisions per second <b>OR</b> lower collision rate (then the reaction) stopped all the hydrochloric acid reacted	<b>4</b>
8(a)(ii)	any 4 from: faster (reaction) (powder has) larger surface area more collisions per second <b>OR</b> higher collision rate same volume of gas amount / moles hydrochloric acid is not changed	<b>4</b>
8(b)	any 5 from: temperature increased particles have more energy (particles) move faster more collisions per second <b>OR</b> higher collision rate more particles have sufficient energy to react / activation energy more of the collisions are successful	<b>5</b>